

SYSTEMATIC STUDY OF TEXAS POPULATIONS OF *PHACELIA PATULIFLORA* (HYDROPHYLLACEAE)

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ABSTRACT

Populations of *Phacelia patuliflora*, a species of the southeastern United States and closely adjacent Mexico, were investigated in Texas. The species was formerly treated as having two varieties, *P. patuliflora* var. *patuliflora* and *P. patuliflora* var. *teucrifolia*. The present investigation suggests that an additional regional variety from south Texas be recognized for which the name *P. patuliflora* var. *austrotexana* J.A. Moyer, var. nov. is proposed. A key to the varieties of this complex along with a map showing their distribution is included.

RESUMEN

Se investigaron en Texas poblaciones *Phacelia patuliflora*, una especie del sureste de los Estados Unidos y partes adyacentes de México. Se reconocían anteriormente dos variedades, *P. patuliflora* var. *patuliflora* y *P. patuliflora* var. *teucrifolia*. La presente investigación sugiere que puede ser reconocida una variedad regional adicional del sur de Texas, para la que se propone el nombre *P. patuliflora* var. *austrotexana* J.A. Moyer, var. nov. Se incluye una clave para las variedades de este complejo junto con un mapa que muestra su distribución.

KEY WORDS: Hydrophyllaceae, *Phacelia*, Texas

Phacelia patuliflora belongs to section *Cosmanthus* Brand of the Hydrophyllaceae. This section is characterized by the presence of a gland or nectary on the principal vein of the corolla (Constance 1949). *Cosmanthus* consists of 14 species with a south to north distribution starting in the Guatemalan and the Mexican highlands and extending northwards into Texas and Oklahoma and eastward through the Ozarks to the Appalachians. Other species of *Phacelia* do not overlap the distribution of the subgenus *Cosmanthus*, with the exception of *P. congesta* Hook. and its few relatives, which are not morphologically or cytologically similar to *Cosmanthus* (Constance 1949). Gillett (1968), in his cytological work on *Cosmanthus*, also recognized 14 species in the section. Turner (1991) has recently added three additional new species, *P. altotonga*, *P. carmenensis*, and *P. neffii*, to the *Cosmanthus* complex.

The *Phacelia patuliflora* complex is most commonly aligned with *P. strictiflora* and *P. laxa* (Constance 1949, 1950; Gillett 1968). As indicated in Fig. 1 and in the taxonomic treatment that follows, we recognize three infraspecific elements

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in the group, all of which are distinctly allopatric and show little or no tendency to intergrade when observed in the field. The var. *austrotexana*, a segregate from var. *patuliflora* as treated by Constance, is probably closer to *P. laxa* Small than it is to *P. patuliflora* var. *patuliflora* [which appears equally close to *P. strictiflora* (Engelm. & Gray) A. Gray, according to Constance (1949)]. Indeed, Constance in his discussion of *P. laxa*, states that the species is:

... exceedingly difficult to separate from *P. patuliflora* in the herbarium ... since all the character of *P. laxa*, except perhaps the low number of ovules, have been diffused into *P. patuliflora*, its distinctness rests solely upon a combination of characters, none of which is clearly distinguishing in itself.

He goes on to note, however, that in the field it is easily recognized by its small, pale flowers, petiolate cauline leaves, sparse pubescence and preference for shaded alluvial situations, all of which the senior author also observed in her field excursions. Nevertheless, Constance opined that *P. laxa* has been very nearly "swamped out" by the competition from its own recombinational products with *P. patuliflora* var. *teucrifolia*. Our field observations and examination of distributional ranges, make it difficult to accept that *P. laxa* has, to any considerable extent, hybridized with *P. patuliflora* var. *teucrifolia*. Rather, the distribution pattern and morphological data strongly suggest that *P. patuliflora* var. *austrotexana* is a regionally differentiated taxon little affected by hybridization from *P. laxa* or other taxa. Whatever its origin, it would appear on both morphological and geographical grounds that *P. laxa* is much closer to *P. patuliflora* var. *austrotexana* than it is to *P. patuliflora* var. *teucrifolia*.

BIOGEOGRAPHY

The three varieties of *Phacelia patuliflora* in Texas are distinctly separated geographically (Fig. 1). Interestingly, the collective distribution of the subgenus *Cosmanthus* indicates a migration northward from Mexico (Constance 1950; Turner 1991). Within Texas this migration presumably allowed for geographical diversification and habitat specialization for each variety.

Phacelia patuliflora is characterized by hard-to-locate but often relatively dense populations which appear to be thriving. The species is not present in many apparently suitable areas near the known populations. Frequent human disturbance or overgrazing at the sites where *P. patuliflora* does occur might explain the difficulty in locating sizeable colonies.

TAXONOMIC TREATMENT

Phacelia patuliflora (Engelm. & A. Gray) A. Gray, Proc. Amer. Acad. Arts 10:321. 1875. *Eucota patuliflora* Engelm. & A. Gray, Boston J. Nat. Hist. 5:45. 1845. TYPE: U.S.A: TEXAS: Austin Co.: in a woods near San Felipe, Mar 1843, Lindheimer II-280 (HOLOTYPE: GH; ISOTYPES: NY, MO).

Phacelia hispida Buckl., Proc. Acad. Nat. Sci. Philadelphia 13:463. 1862. non A. Gray 1878. TYPE: U.S.A.: TEXAS: Travis Co.: Austin, 1860, *Buckley s.n.* (HOLOTYPE: PA; ISOTYPES: GH, MO).

KEY TO THE VARIETIES OF *PHACELIA PATULIFLORA*

1. Peduncles with small, well-defined, glandular hairs, these ca 0.1 mm in length and dispersed among a rather even vestiture of mostly short, non-glandular hairs 0.5 mm in length or less var. *patuliflora*
1. Peduncles without glandular hairs, the vestiture various but not as described in the above (2)
 2. Calyx lobes markedly acute, elongating in fruit to twice the length of the invested capsules; calcareous soils of west-central Texas and adjacent Mexico var. *teucrifolia*
 2. Calyx lobes rounded or rather abruptly obtuse; mostly sandy soils of southern Texas var. *austrotexana*

Phacelia patuliflora* (Engelm. & A. Gray) A. Gray var. *patuliflora

Annual herbs, 8–60 cm high, branching at the base with branches stiffly ascending to decumbent. Leaves rarely rosulate or persistent, petiolate, truncate at base, oblong to oval, 2–10 cm long, 1–4 cm broad, pinnately lobed to pinnatifid with 1–7 pairs of smaller lobes or remote leaflets at base and a larger terminal lobe, all coarsely dentate or lobed with obtuse or acute teeth, strigulose to hirsute on both surfaces, the cauline leaves reduced, mainly sessile, oblong and coarsely dentate, distinctly lobed. Inflorescence a scorpioid cyme of 5–30 flowers, loosely hirsute to strigulose or canescent; the peduncles with small, well-defined glandular hairs, the latter about 0.1 mm in length; the mature pedicels weakly ascending to widely spreading or decumbent, 3–15 mm long. Corolla, purplish-violet to lavender, commonly with white centers, broadly campanulate to rotate-campanulate, 8–16 mm broad, the lobes finely crenulate, moderately to sparsely pilose on back. Stamens 5–8 mm long, included, the anthers 1.0–1.5 mm long. Style included, cleft to midpoint, hirsute below. Capsule globose, 4–6 mm across, the seeds 10–15, about 2 mm in length, ovoid-angled, brown, areolate and finely alveolate. Chromosome number, $n = 9$ pairs.

Distribution and Ecology: Central and eastern Texas (Fig. 1) mainly in sandy soils of roadsides, railroad embankments and alluvial soils of stream and river beds. The plants occur in disturbed areas in full sun or in partial shade of deciduous roadside thickets. Often grazed, plants begin to flower in mid-March, peak in early April and have set seed by the middle of May.

Population Site Descriptions: (Fig. 1) Three populations, 5–15 individuals each, of var. *patuliflora* were found in Burnet County on April 13, 1991. Populations 1, 2 and 3 were located on sandy, well-drained roadside banks in the Buchanan Dam area. These sites were situated on large sandstone outcrops with smaller flags present on the surface. Some of the plants in all of the sites had been grazed.

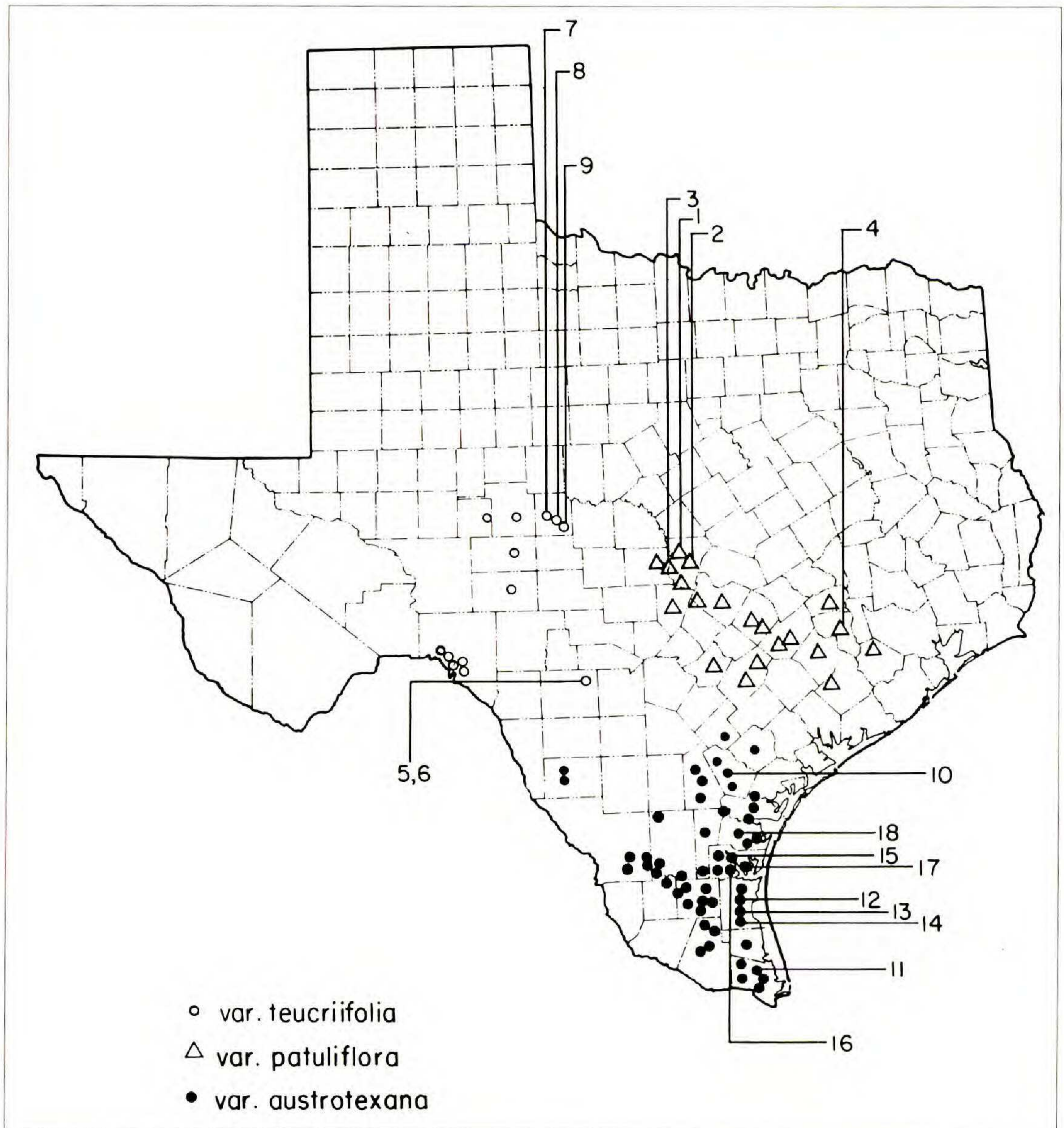


Fig. 1. Distribution of *Phacelia patuliflora* in Texas based upon specimens at LL, TEX. Populations examined in the field and discussed in the text are labeled accordingly.

Interestingly, plants were confined to the sandy areas, although tracts with abundant humus were in close proximity. Grasses and occasional plants of *Opuntia macrorhiza* characterized the area.

Population 4 of var. *patuliflora* was observed at or near the type locality in San Felipe, Texas on April 3, 1992. This population was rather dense, with 1000–1500 plants covering approximately half an acre. The plants were growing in very sandy loam with a few sandstone outcrops and were located in full sun. Other plants growing in this area were *Lupinus texensis*, *Pyrrhobappus pauciflorus*, *Gaillardia pulchella*, *Cirsium texanum* and *Castilleja indivisa*.

Phacelia patuliflora* var. *teucრიifolia (I.M. Johnst.) Constance. TYPE: MEXICO. COAHUILA: Muzquiz, 12 Apr 1936, *Marsh 2120* (HOLOTYPE: GH; ISOTYPE: TEX!).

Annual herbs, 10–60 cm high, branching at the base with branches stiffly ascending. Leaves rarely rosulate or persistent, petiolate, truncate at base, oblong to oval, 2–10 cm long, 1–4 cm broad, pinnately lobed to pinnatifid with 1–7 pairs of smaller lobes or remote leaflets at base and a large terminal lobe, all coarsely dentate or lobed with obtuse or acute teeth, strigulose to hirsute on both surfaces, the cauline leaves reduced, mainly sessile, oblong and coarsely dentate, distinctly lobed. Inflorescence a scorpioid cyme of 5–30 flowers, loosely hirsute to strigulose or canescent, the mature pedicels weakly to stiffly ascending, 3–15 mm long. Corolla, purplish-violet to deep bluish-purple, commonly with white centers, broadly campanulate to rotate-campanulate, 12–20 mm broad, the lobes finely crenulate, moderately to sparsely pilose on back. Stamens 5–8 mm long, included, the anthers 1.0–1.5 mm long. Style included, cleft to midpoint, hirsute below. Capsule globose, 4–6 mm across, the seeds 10–15, about 2 mm in length, ovoid-angled, brown, areolate and finely alveolate. Chromosome number, $n=9$ pairs.

Distribution and Ecology: Edwards Plateau region of Texas southward to Mexico (Figure 1). Plants commonly occur in calcareous soils in draws and river beds as well as along roadsides. Populations are frequently located in the partial shade of deciduous trees and in the full sun of disturbed roadside ditches. Flowering begins in late March with its peak in mid-April. Seeds are set and plants die back by late May.

Population Site Descriptions: (Fig. 1) Populations 5 and 6 occurred in Montell, Uvalde County and were sampled in mid-April of 1991. Both were located on highway embankments. Populations were comprised of 20–50 plants which were widely scattered, located in full sun and on the naturally calcareous soil of the western Edwards Plateau region. Associated species included, *Delphinium carolinianum*, *Callirhoe involucrata*, *Verbena bipinnatifida* and *Phlox drummondii*, as well as assorted grasses.

Populations 7, 8 and 9 were all located along the San Saba River in Menard County. These sites were characterized by calcareous soils of a grainy nature that seemed well drained. Populations 7, located at a picnic area on highway 83, two miles south of Menard, and population 8, located in the town of Menard, were situated in the partial shade of pecan bottoms. Both populations were dense, comprised of 500–1500 individuals. Other species in these areas included *Oenothera speciosa*, *Gaura coccinea* and *Penstemon triflorus*.

Population 9 was located on the banks of a road cut along FM 1311 where it crosses the San Saba River and was comprised of 24 individuals. The soil at this site was sand that appeared to have been recently deposited. It was also in

partial shade. Associated species were grasses and abundant individuals of *Clematis pitcheri*.

***Phacelia patuliflora* var. *austrotexana* J.A. Moyer, var. nov.**

Differt a *Phacelia patuliflora* (Engelm. & A. Gray) A. Gray var. *patuliflora* trichomatibus glandulosis carentibus.

Annual herbs, 8–60 cm high, branching at the base with branches stiffly ascending to decumbent. Leaves rarely rosulate or persistent, petiolate, truncate at base, oblong to oval, 2–10 cm long, 1–4 cm broad, pinnately lobed to pinnatifid with 1–7 pairs of smaller lobes or remote leaflets at base and a large terminal lobe, all coarsely dentate or lobed with obtuse or acute teeth, strigulose to hirsute on both surfaces, the cauline leaves reduced, mainly sessile, oblong and coarsely dentate, distinctly lobed. Inflorescence a scorpioid cyme of 5–30 flowers, loosely hirsute to strigulose or canescent; the mature pedicels weakly ascending to widely spreading or decumbent, 3–15 mm long. Corolla, purplish-violet to lavender, commonly with white centers, broadly campanulate to rotate-campanulate, 7–16 mm broad, the lobes finely crenulate, moderately to sparsely pilose on back. Stamens 5–8 mm long, included, the anthers oblong 1.0–1.5 mm long. Style included, cleft to midpoint, hirsute below. Capsule globose, 4–6 mm across, the seeds 10–15, about 2 mm in length, ovoid-angled, brown, areolate and finely alveolate. Chromosome number, $n=9$ pairs.

TYPE: U.S.A.: TEXAS: San Patricio Co.: along railroad ca. 2.5 mi. SW of Sinton, 22 Mar 1969, *D.S. Correll* 36834 (HOLOTYPE: LL!; ISOTYPE: TEX!).

Representative specimens: TEXAS. **Bee Co.:** just south of Pettus, 2 Mar 1968, *Correll* 35511. **Brooks Co.:** King Ranch, Encino Division, 26 Apr 1949, *Lundell* 14975. **Cameron Co.:** Arroyo Colorado, Harlingen, 13 Mar 1964, *Correll* 28973. **Dimmit Co.:** Carrizo Springs, 12 Mar 1964, *Cuellar* 43. **Duval Co.:** 7 mi W of Hebbronville, 5 Mar 1962, *Trivino* 4. **Goliad Co.:** open places, Mar 1927, *C.B. Williams* 45. **Hidalgo Co.:** S of Encino, 19 Mar 1942, *Lundell* 10829. **Jim Hogg Co.:** Hebbronville, 14 Mar 1931, *Tharp s.n.* **Jim Wells Co.:** field at Alfred, 30 Mar 1970, *Correll* 38310. **Kenedy Co.:** Sarita along Hwy 96, 14 Mar 1941, *Runyon* 2469. **Kleberg Co.:** 10 mi S of Kingsville, 6 Mar 1959, *Turner* 4467. **Live Oak Co.:** along US Hwy. 59, 20 SW of Georgewest, 14 Mar 1964 *Fowler & Vergara* 99. **Nueces Co.:** Petronila Creek, between Bishop and Chapman Ranch, 12 Mar 1964, *Correll* 28925. **San Patricio Co.:** near Mathis, 29 Mar 1941, *Lundell* 10081. **Webb Co.:** 8.3 mi S of Mirando City, 16 Mar 1966, *Correll* 32259.

Distribution and Ecology: South and southeastern Texas in the sandy, well-drained soils of roadsides and alluvial stream beds (Fig. 1). Found in the following counties: Bee, Brooks, Cameron, Dimmit, Duval, Goliad, Hidalgo, Jim Hogg, Jim Wells, Kenedy, Kleberg, Live Oak, Nueces, San Patricio, Webb. Populations were found most frequently in full sun and often comprised the only vegetation in highly disturbed areas. Flowering begins in March with maximum anthesis in early April.

Population Site Descriptions: (Fig. 1) Population 10, located in Bee County,

was sampled on 12 March 1991. It was comprised of approximately 500–700 plants which were found growing on the banks of a roadside drainage area in downtown Beeville. The drainage ditch walls and associated bank were comprised of sand with gravel and was located in the full sun. The population extended to a railroad embankment located approximately 20 meters from the roadside area. This embankment, also comprised of sand and gravel, was located in full sun and was well-drained. Individuals were not found in the 20 meter swath of loamy sand that lay between the drainage area and the embankment. Associated species found growing in the sand and gravel included *Corydalis micrantha* and isolated individuals of *Opuntia macrorhiza*.

Population 11 was collected in Cameron County on 14 March 1991. The site was in an abandoned commercial area off of the access road to Highway 77. Approximately 100–150 individuals were growing in what appeared to have been a sand and gravel parking lot in direct sun. No plants were found in a nearby (20 meters distance) overgrown garden area of rich loam.

Kenedy County was visited on 14 March 1991 and three populations were located. Population 12 was located along Highway 77 on the sandy berm of a drainage area. The berm, located in full sun, appeared to have been deposited some years prior and was comprised entirely of sand. Approximately 50 individuals were growing in association with *Sisyrinchium ensigerum* and varied grasses.

Population 13 was the only partially cultivated population found. Several thousand individuals were growing in the sandy loam of Sarita Square in the center of Sarita. These plants were being watered daily. All individuals were located in full sun in association with *Gaillardia pulchella*, *Castilleja indivisa*, *Sisyrinchium ensigerum*, *Gaura coccinea*, *Argemone albiflora* and varied herbs and grasses.

Population 14 was located along a roadside and the railroad embankment running parallel to and approximately 15 meters from Highway 77 near Ytturia. This site was characterized by extremely dry, well-drained sand and gravel. Approximately 100–200 individuals were present with only sparse grasses.

Three populations were found in Kleberg County on 14 March 1991. Population 15 was comprised of 15 plants and was located on the alluvial sand of Escondido Creek just south of Kingsville. Individuals were found only in the sand of the banks, and not in the surrounding grassy field. All individuals were located in full sun. Associated species included *Buchnera floridana* and *Phlox drummondii*.

Population 16 occurred on a railroad embankment along Highway 77 at its junction with FM 1118 in alluvial sand and gravel. The 22 plants observed were in full sun and were widely separated. Associated vegetation was comprised of *Corydalis micrantha*, *Cirsium texanum*, *Opuntia macrorhiza*, and *Sisyrinchium ensigerum*.

Population 17 was also growing on a railroad embankment running parallel to Highway 77 just south of its junction with FM 628, in gravelly sand.

This population was widely scattered and was comprised of approximately 50–60 individuals. However, this group was in the partial shade of a large *Acacia* grove. *Corydalis micrantha* and *Sisyrinchium ensigerum* were the only other species found on the embankment.

Population 18 was located in Nueces County and was sampled on 13 March 1991. It was comprised of 25–50 individuals growing in sand at the foundation of a roadside warehouse off of the Padre Island Expressway in Flour Bluff. The individuals were restricted to the sandy soils that appeared to have been placed at the foundation for the purpose of creating a drainage bank. The site was located in full sun; grasses were the only other species present.

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REFERENCES

- CONSTANCE, L. 1949. A revision of *Phacelia* subgenus *Cosmanthus* (Hydrophyllaceae). Contr. Gray Herb. 168:1–48.
- . 1950. Some interspecific relationships in *Phacelia* subgenus *Cosmanthus*. Proc. Amer. Acad. Arts 78:135–147.
- GILLETT, G.W. 1968. Systematic relationships in the *Cosmanthus* and *Phacelias* (Hydrophyllaceae). Brittonia 20:368–374.
- JOHNSTON, I.M. 1943. New Phanerogams from Mexico. J. Arnold Arbor. 24:90–98.
- TURNER, B.L. 1991. New species of Mexican *Phacelia*, subgenus *Cosmanthus* (Hydrophyllaceae). Phytologia 71:445–452.